

appeared wholly nebulous, with a bright central condensation; the tail broad, but faint. I could only trace it some 2" or 3". The brightness of the nucleus must have been considerable, as when close to the horizon I could see it through a pretty thick cloud. Subsequently the nucleus has seemed to me decidedly more disk-like, I suppose from being better seen. I may add that the sunset-glows and the unusually cloudy weather we are having have interfered greatly with satisfactory observation.

Nelson, N.Z., February 1

A. S. ATKINSON

The Access to Mountains and Moorlands Bill

I AM glad to observe that you have called the attention of scientific men to the importance of Mr. Bryce's Bill. Perhaps nothing can better show the need of such a measure than certain facts in regard to the Clova district in Forfarshire, which is classic ground to the botanist; indeed, I think I may venture to say that it is the richest ground in the British Islands. From time immemorial a right of way existed through Glen Dale, and, I can remember the time when botanists could ascend any of the hills in that district without being subjected to the tender, though somewhat embarrassing attention of gamekeepers. I have good reason to believe that the case is somewhat altered in recent years, and that, after a man has gone hundreds of miles in order to see *Oxytropis campestris* growing in its only British station, he may find himself turned back just within sight of the goal. The thing can still be done by taking advantage of a curious fact in natural history, viz. that two gamekeepers cannot remain long in loving converse with three men: by keeping this fact in mind, one out of three may still study the botany of Clova. After having gone pretty well over Scotland I am glad to say that there are many places in which there is no need for Mr. Bryce's Bill. In most cases in which it is needed it is where "new men" usurp a power which the old lords of the soil never dreamt they possessed.

Edinburgh, March 24

A. CRAIG-CHRISTIE

A Sixth Sense

IN the valuable address given by Sir William Thomson at the Midland Institute, Birmingham, on October 3, and reported so fully in the columns of NATURE, it is implied that Dr. Thomas Reid of Glasgow brought out the distinction of a sixth or muscular sense. I cannot find any satisfactory evidence of this, although Reid came very near it indeed when he stated in his "Inquiry into the Human Mind," chap. v. section 1:—"By touch we perceive not one quality only, but many, and those of very different kinds;" and again:—"There is, no doubt, a sensation by which we perceive a body to be hard or soft;" and again, further on he even speaks of its being strange that this sense should "be so much unknown as never to have been made an object of thought or reflection nor to have been honoured with a name in any language."

And on the other hand, while I cannot detect any attempt whatever to refer this sensation to the muscles as its peripheral origin, while speaking of our conception of the hardness of bodies, Dr. Reid says (p. 121, ed. of 1846):—"We have no way of coming at this conception and belief, but by means of a certain sensation of touch;" and again, "I see nothing left but to conclude that, by an original principle of our constitution, a certain sensation of touch both suggests to the mind the conception of hardness and creates a belief of it." Reid, in short, like his eminent predecessor Hutcheson in the same chair, was dissatisfied with the ordinary division of the senses, and really felt disposed to split up the varied phenomena bundled up under the term "touch" into two or more divisions; but it was reserved for Dr. Thomas Brown, a good physiologist according to the light of the times, and Professor of Moral Philosophy in Edinburgh (1810-20), explicitly to complete the distinction hinted at by Reid, and to refer our conception of resistance or tension (as we find in estimating weights by the hand) to a distinct sixth or muscular sense. Thus in his twenty-second lecture he says:—"The feeling of resistance is, I conceive, to be ascribed, not to an organ of touch, but to our muscular frame, to which I have already more than once directed your attention, as forming a distinct organ of sense." In the lecture which follows that, Brown admits the frequent mingling of mere tactual sensation with that of muscular effort:—"But it is not of this mere tactual feeling we think when we term bodies hard or soft—it is of the greater or less resistance which they afford to our muscular contraction."

It is remarkable that the teaching of this eminent psychologist, the preceptor of James Mill, should so early have been forgotten in Scotland.

HENRY FAULDS

Laurel Bank, Shawlands, Glasgow, March 18

MR. FAULDS, in the preceding letter, is no doubt quite correct in remarking that the distinction pointed out and insisted on (not merely hinted at) by Thomas Reid, a little more than a hundred years ago, in the Moral Philosophy Chair of the University of Glasgow, was more clearly and fully defined by his eminent successor in Edinburgh, Thomas Brown. But I cannot agree with his last sentence, implying that Thomas Brown is forgotten in Scotland. In fact, my mind was so full of Reid and Brown, from my recollections of the teachings of the Professors of Moral Philosophy and Logic in this University, that, in giving my address at Birmingham, I said Thomas Brown, meaning Thomas Reid, but feeling the names of Reid and Brown both thoroughly mixed up with all I had ever learned of this subject.

WILLIAM THOMSON

The University, Glasgow, March 20

Earthworms

THE theory of the formation of vegetable mould through the action of earthworms, by Darwin, received little attention when published from people who had been accustomed to examine the soils of various countries. That the vegetable soil had been formed as he states seemed to have been accepted by his followers without hesitation. In your columns, however, of late, letters have appeared from Messrs. R. M. Christy and T. E. Wilcox, showing that earthworms do not exist in the prairies in the north-west of Canada or in the United States, in those of Kansas, the Indian Territory, or in Idaho and Washington Territory. This is simply what may be expected. Notwithstanding the keenness of observation of Darwin and his width of observation, there seem vast regions where earthworms have had little to do with the formation of the vegetable soil. In many parts of Australia, and also in the moister climate of New Zealand, the soil affords few indications that earthworms ever passed it through their bodies. In a section of soil I brought from the Matura plain, South Island of New Zealand, nothing could be seen to indicate that worms had ever swallowed it. That vegetable soil forms a fit habitation for earthworms is undoubted. Darwin admits "that a layer, though a thin one, of fine earth, which probably long retains some moisture, is in all cases necessary for their existence." Before this thin layer existed, how could they—the worms—form vegetable soil? This thin layer must have been formed in some other way; Darwin does not say how. It is not necessary to call in the aid of earthworms to do so. The very name which has been universally applied to the thin upper covering, the exterior film enveloping the surface of the deposits underneath, viz. vegetable soil, speaks to its origin in the decay of vegetation. Take for instance the boulder-clays of this part of the Lothians in Scotland, with their tough, stony texture, their pebbles as finely striated as when the ice squeezed them into the pasty mass of crushed shales out of which they appear to have been partly formed. While these surfaces could have afforded none of the conditions required by Darwin, or indeed supply any other save inorganic food, the slow growth on their surfaces of the more simple forms of vegetable life, and their decay, would in the lapse of ages supply the thin film which Darwin requires. It surely, then, is attempting too much to ascribe to the earthworm the formation of the vegetable soil. The earthworm is not the only occupant of the material which the growth and decay of vegetation supplies as a surface covering. The earthworm is not the only drainer. The roots of many plants not only descend deeply into the subsoils, but also fetch up from depths where worms could not reach supplies of material to mix with the superficial covering; and so do the various insects which have their habitat in the soil, burrowing as they go, and casting, like the mole, the stuff behind them or upwards as they descend.

So far as I have examined soils, I am inclined to think that the earthworm is far more plentiful when animal matter in a decaying state is applied to soils near the dwellings of man, or when his deposits are laid over those of the larger animals. As against the views of Hutton and Playfair, and as stated by Darwin, that the vegetable soil or mould is always diminishing, I have to say it seems entirely the reverse; it seems to have had a be-

gunning, is increasing, and shall increase so long as vegetable and animal life covers the surface of the earth. This is not the case where vegetation ceases to cover the surface, and the sun and wind get direct access to the surface; any soil that may have been formed there soon disappears. In such situations, until vegetation has again spread itself, all the earthworms that could congregate there would only add to the decaying animal matter, as live they could not, there being no food for them in the absence of vegetation and other animal matter.

Bonnington, Midlothian

JAMES MELVIN

I INCLOSE an excerpt from NATURE of January 3 (p. 213), which I saw in one of our daily newspapers. The observation there made is correct as to the absence of earthworms in the region mentioned, but the reason assigned is, I think, incorrect. It is well known to settlers on virgin soils in this country that in the first tillage of the ground they will see no earthworms. This is equally the case whether they settle upon prairie land which has been swept annually by fires, or upon wood land which has been cleared for cultivation and which has never been burned over. Even in the natural meadows called "beaver meadows," which one will chance upon in an otherwise completely forest-covered region, one will at first find no sign of the earthworm. Some sluggish stream is dammed by a colony of beavers, and the land flooded is cleared of trees by them. Alluvial deposits accumulate, and when the beavers have been killed or driven away the dam is destroyed by freshets, and the little stream regains its former dimensions, while the flooded ground, drained naturally, becomes a meadow covered with wild grasses nourished by rich depths of soil. But, until settlement and tillage by man, there is no trace of earthworms even in these most favourable localities. At first they are found about the stableyard, then in portions of ground enriched by stable manure, garden or meadow, till at length they may be found in all soils, either those cultivated or those pastured by domesticated animals.

For years I have been accustomed to go to Mukoka, in the Canadian Dominion, for shooting and fishing. This section is a wooded wilderness with numerous lakes and streams. It is still Governmental wild land, and in part unsurveyed for settlement. The frontier settlers there tell me that until a place has been inhabited for five years it is useless to search for the earthworm.

H. F. WALKER

8, East Thirtieth Street, New York City, U.S.A.,

March 5

The Remarkable Sunsets

THE following extract from a letter written at Auspaki, province of Vitebsk, Russia, may be of interest:—

"February 26 (Old Style), March 9

"February has been the coldest and the pleasantest month this winter, particularly the latter part of it; frost from 5° to 12° Reaumur; bright sunshine. Now we have been able to see the roseate sunsets, which for at least three months have been hidden by clouds. We are, however, so accustomed to brilliant sunsets here, that we might not have remarked them if our attention had not been directed to them. Here, generally, when the sky is clear and the frost severe, the eastern horizon is a misty blue, above which is a rosy streak melting away into the clear blue above. But these latter sunsets have differed from that in a great measure. The west has often been blood-red, and the eastern horizon has been rosy, not so much in a streak but in patches, which have sometimes been visible over head. At the beginning of the month I was in Riga, and found the river open below bridge; indeed, the navigation has not been closed the whole winter. Snow there was none in Riga, and I saw them carting the most miserable ice for the ice-cellars; I think it was little more than six inches thick. We have been favoured here; we have retained our snow, and have had, and still have, good sledge roads. We filled the ice-cellar the day before yesterday, and the ice was more than a foot in thickness. . . ."

J. M. HAYWARD

Sidmouth, March 24

THOUGH we are no longer favoured with the gorgeous sunsets which marked the autumn and early winter, yet two phenomena are still frequently visible which seem referable to the same cause as those splendid displays.

The first is the unusual *white glow* in the western sky before

sunset which was an almost constant precursor of the brilliant and long-continued colouring of the past months. It was very marked on November 8, the occasion of the first remarkable sunset, and it is still to be seen on almost any fine evening before the sun sets, though it is no longer followed by the more striking phenomena.

The second is a decidedly unusual *pink tinge* occasionally visible for some ten to twenty degrees round the sun when shining in a somewhat hazy sky, the colour being brought out with great distinctness if light cumulus cloud happens to be passing across it. I first observed it about 1 p.m. on Sunday, March 2, and it was very marked last Thursday (20th) between 10 and 11 a.m., and again on Friday (21st) between 1 and 2 p.m., as well as on one or two other days which I have not specially noted.

May not both be due to the gradual subsidence to a lower level in our atmosphere of the particles which at a higher elevation caused the wonderful colouring of the past months?

Hampstead, March 24

B. W. S.

P.S.—Since first writing the above, I see in NATURE that it was from March 1 to 3 that the fall of dust was noticed at Killecraggan. Writing from the neighbourhood of London, it may be as well to say that the appearance is wholly different from any effect of London smoke (with which I have been familiar for nearly fifty years) both in colour and in being produced at a higher level than that of ordinary clouds.

"Curious Habit of a Brazilian Moth"

IN NATURE for May 17, 1883 (p. 55), appeared a letter entitled as above, by Mr. E. Dukinfield Jones, in which the author stated that he had observed a kind of moth in Brazil engaged in sucking up water in large quantity through its proboscis. I may say that this strange habit is not confined to *Panthera apardalaria*, as I have observed the same thing in two species of butterfly (*Papilio oriscabus*, B., and *Appias saba*, F.), and imagine that the phenomenon is by no means rare. These two butterflies are very common by the sides of streams and damp places on the Ankay plain in Madagascar.

One morning while sitting by the side of one of these streams I noticed the *Papilio*, which is an insect measuring about four inches from tip to tip of its wings, resting on the wet bank; and wishing to procure it as a specimen, I approached it as gently as possible, the creature being apparently so absorbed in what it was about as to be totally unconscious of my proximity to it. Noticing strange and unaccountable movements—sundry jerks and probings with its proboscis—I quietly sat down near it to watch it more closely. I observed that every second or two a drop of pure liquid was squirted (not exuded merely) from the tip of its abdomen. I picked up a leaf that was lying near, and inserted the edge of it between the insect's body and the ground so as to catch the liquid. Unfortunately I had no watch with me at the time, nor means of measuring liquids; but I reckoned that about thirty drops were emitted per minute. I held the leaf for about five minutes—as nearly so as I could reckon—and at the end of that time there was caught in it about a saltspoon full of what seemed to be pure water, without either taste or colour. After watching the butterfly for a time, I seized it by the wings between my thumb and fingers with the greatest ease, so utterly lost did it appear to be to what was going on near it.

In another spot I saw as many as sixteen of these large butterflies within the space of a square foot, all engaged in the same strange action. Some of them emitted the liquid more frequently and in greater quantity than others; and one of them squirted the liquid so as to drop fully a quarter or a third of an inch beyond the point on the ground perpendicular with the end of its body. It was at this spot that I saw the second of the butterflies alluded to also engaged in the same curious proceeding.

Antananarivo, Madagascar, January 3

R. BARON

Representation of Students

THE students in residence at Girton College are indirectly represented by the members elected by the "certificated students," but cannot themselves, whilst they are in the condition of undergraduates, elect a representative on the governing body.

The College Hall of Residence has advanced one step further in the same direction by offering direct representation to students *in residence*, and it is this new departure which was mentioned in NATURE (vol. xxix. p. 388).